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G01M 1/34

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B7C CKF

(56) Documents Cited
GB 2067140 A US 4014139 A US 3808660 A

(58) Field of Search
UK CL (Edition K) B7C CKF , G1X
INT CL^5 G01M

(54) Wheel balancing method and apparatus.

(57) A wheel and tyre combination is dynamically balanced by machining a portion of the rim of the wheel, for example the bead seats 4a, 4b, eccentrically with respect to the axis of rotation.

FIG.2

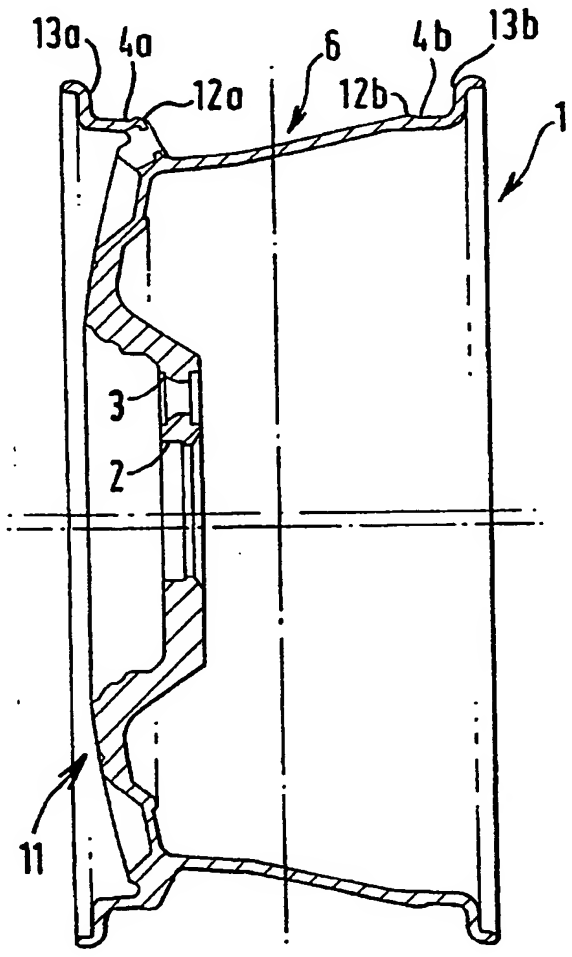

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FIG.2

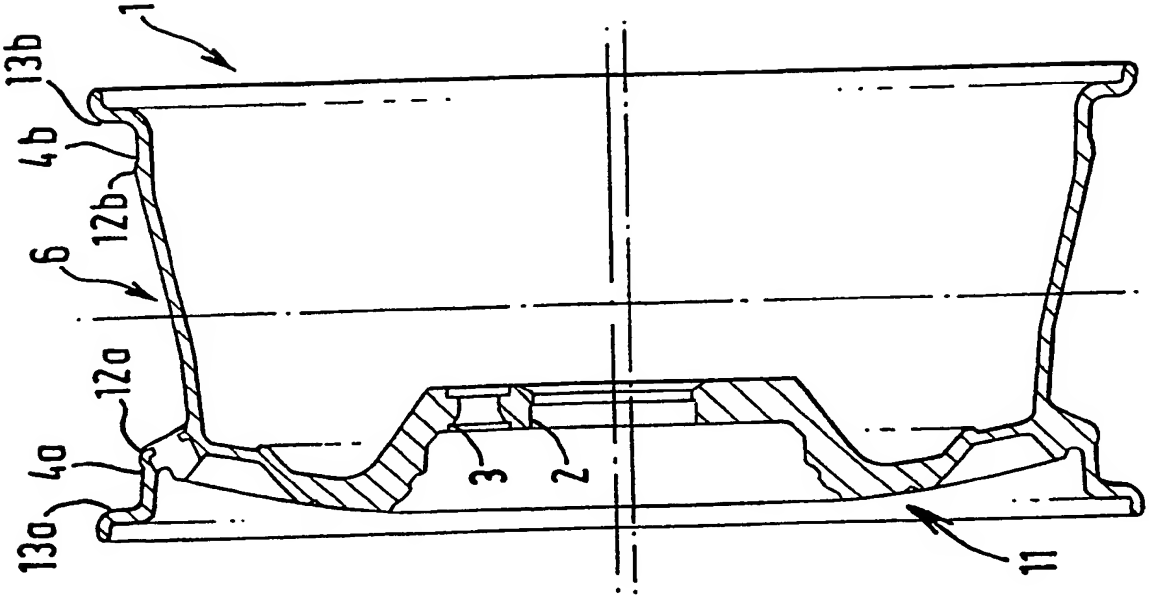


FIG.1

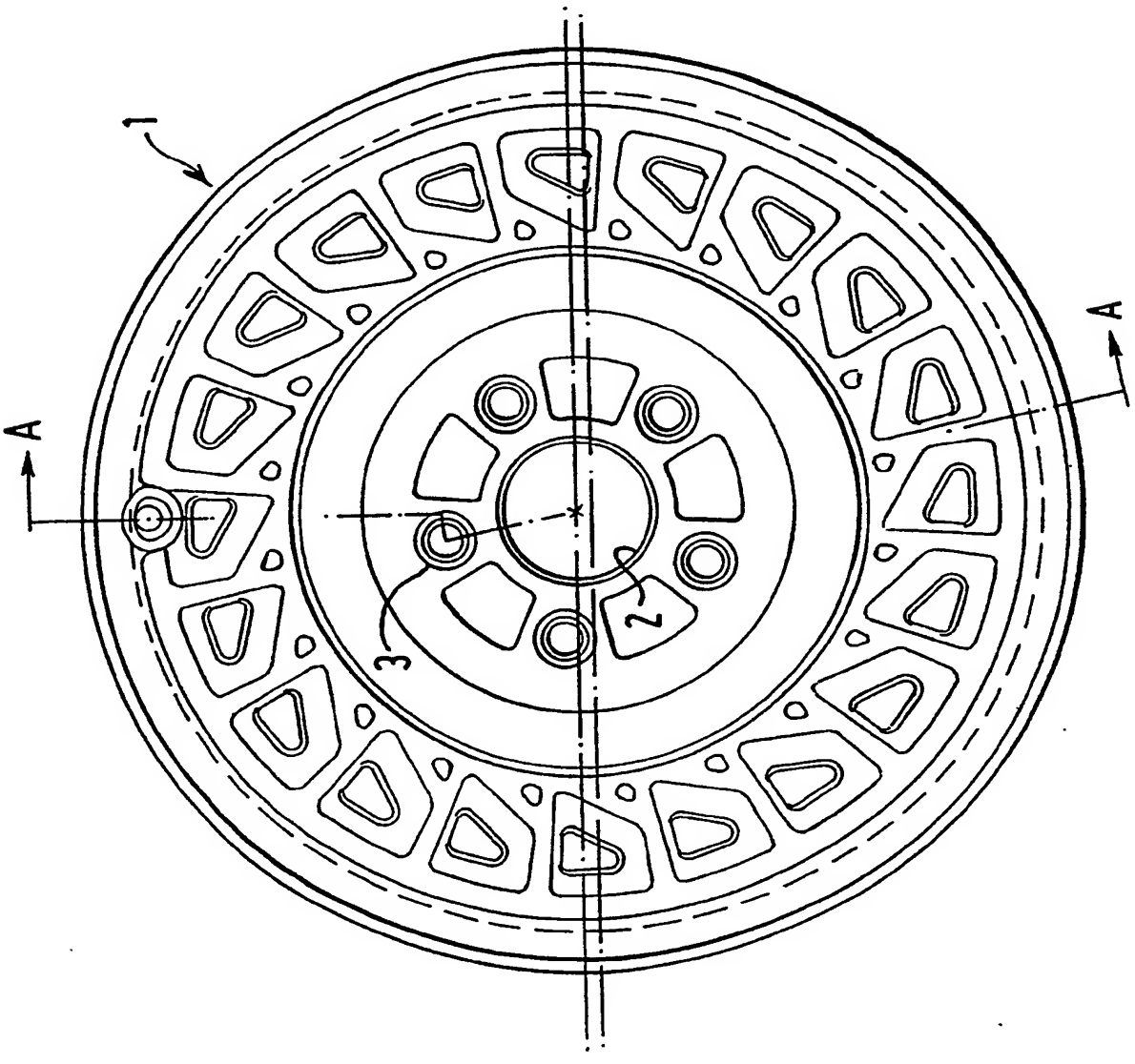
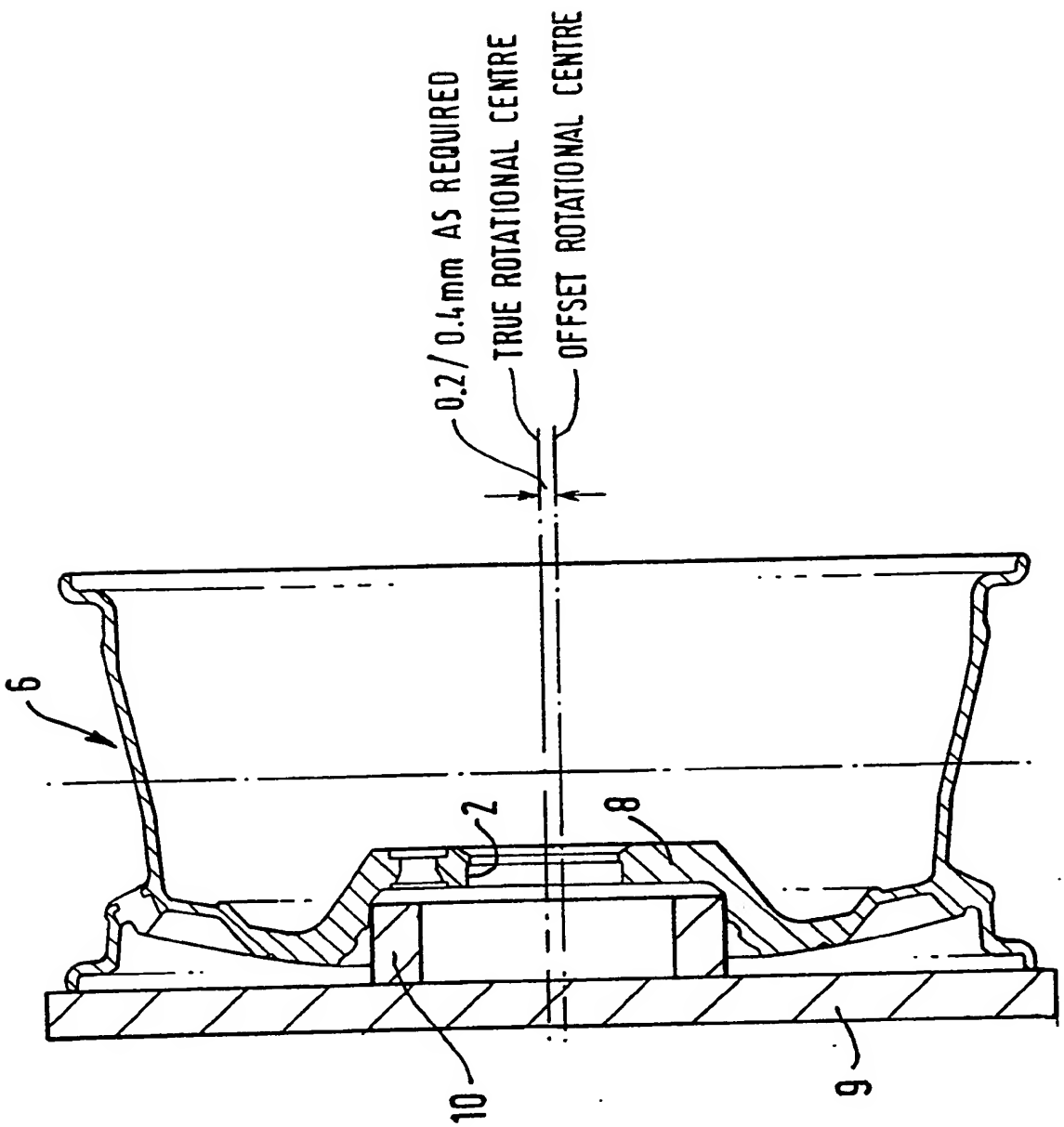


FIG.3


0.2/0.4mm AS REQUIRED
TRUE ROTATIONAL CENTRE
OFFSET ROTATIONAL CENTRE
6
2
8
10
9

WHEEL BALANCING METHOD AND APPARATUS

The present invention relates to wheel balancing methods and apparatus and more particularly to the balancing of a combined wheel and tyre combination and to the manufacture of a cast alloy wheel for use in such a combination.

A problem exists in the production of a pneumatic tyre and wheel combination which when assembled will run true about the axis of rotation, i.e. be dynamically balanced. Any variations in the symmetry of the tyre and/or wheel can result in significant vibrations occuring when the vehicle to which they are fitted is being driven.

This problem has been recognised and a number of solutions have been proposed. An example of one such solution is disclosed in UK Patent 2067140 (Motor Wheel Corporation).

The characteristic of the approach disclosed in this earlier patent is that the mounting holes through the wheel are adjusted, i.e. deliberately made eccentric with regard to the axis of rotation, in order to compensate for the eccentricity of the tyre to thus

ensure that the wheel and tyre combination as a unit will not generate any significant out of balance forces when being driven on a vehicle.

The disadvantage of this approach is that the whole rim and tyre are offset with respect to the centre of rotation. This increases the out of balance forces which then require correction by the fitting of additional balance weights. Alternatively the inherent out of balance of the tyre is used to compensate these out of balance forces.

The present invention is concerned with overcoming these disadvantages.

According to the present invention a method of balancing wheel and tyre combination comprises:

(a) forming the mounting holes of the wheel concentrically about the rotational axis; and

(b) removing material from an area of the rim of the wheel to compensate for any eccentricity in the tyre itself.

In this context the term "concentrically" means making concentric within the relevant manufacturing tolerances and the term "rim" is intended to cover any part of the wheel outside the central disc.

How the invention may be carried out will now be described by way of example only and with reference to the accompanying drawings in which:

Fig. 1 is an elevational view of a cast-alloy wheel constructed according to the present invention; and

Fig. 2 is a section on the line A-A of Fig. 1.

Fig. 3 is a view similar to Fig. 2 but also showing, diagrammatically, the equipment used in forming the eccentricity according to the present invention.

An alloy wheel 1 one comprises a one piece casting having a centrally positioned circular aperture 2 and, in this example, five mounting holes 3 arranged substantially concentrically around the aperture 2.

In a normal wheel the bead seats are substantially concentric with respec to the true running centre of the wheel within the relevant manufacturing tolerances which are typically 0.3mm (0.011 inches).

It must be emphasised that in the manufacture of the wheel it is the objective to make the aperture 2 and the mounting hole 3 as concentric as possible within the tolerances permitted by the equipment being used.

The aperture 2 is used to locate the wheel to the vehicle hub (not shown) in the case of the original equipment wheels.

In order to compensate for eccentricities and imbalances which are found in the tyres to be mounted on the wheel, the wheel itself is then deliberately adapted to counteract those eccentricities or imbalances.

This adaptation is achieved by eccentrically machining the two substantially cylindrical rim surfaces 4a and 4b in order to remove a small depth of metal, typically 0.25 to 0.35mm, the exact amount being

dictated by the magnitude of the first harmonic required.

Although the eccentricity has been achieved by machining the bead seats 4a, 4b the same effect could be achieved by machining other parts of the wheel, as distinct from achieving the eccentricity by means of eccentrically mounting the wheel.

The equipment used to hold the wheel and to machine the eccentricities referred to earlier is shown diagramatically in Fig. 3.

The first step in the manufacturing process is to introduce controlled first and second harmonics of the average radial runout on the cast aluminium wheel thereby maintaining a low static imbalance.

The wheel casing 1 is mounted on a fixing 9 which itself is mounted in a lathe in order to enable the rim profile 6, bore 2, mounting face 7 and inside skirt 8 to be produced in one operation. The first step is to machine the bead seats to leave sufficient metal for the final finish-machining of the eccentric bead seats 4a, 4b, already described in connection

with Figs. 1 and 2. These seats are cast with sufficient metal to allow for the subsequent two-stage machining referred to earlier in order to enable the desired eccentricity or offset to be achieved.

This first pre-machining step is carried out with the wheel casting rotating on its true rotational centre.

The next step is to eccentrically machine the bead seats 4a, 4b. In order to do so the fixing 9 has a location member 10 which permits various amounts of eccentricity to be achieved in relation to the styling face 11 of the wheel. With this mounting arrangement there are no clamping stresses or tool load distortion. This is because the wheel is machined with it in the same orientation as it would occupy when in use on the vehicle.

The machining of the offset bead seats 4a, 4b will be from the tyre retaining humps 12a, 12b to the substantially vertical, radially outwardly extending, rim flanges 13a, 13b using a computer controlled turning machine (not shown). The original shape of the rim is thus modified to allow the smooth

transition from the retaining humps 12a, 12b to the eccentric machining of the bead seats 4a, 4b.

This method produces a cast aluminium wheel where the mass of the wheel is concentric in relation to the pilot bore 2 and the first and second harmonics of the average radial runout are produced by the offset bead seats 4a, 4b and can be controlled in both magnitude and radial position in order to compensate for any eccentricities or imbalances in the associated tyre to be fitted to the wheel.

This method of production reduces the possible adverse effect on the harmonic position or magnitude caused by any natural distortion of ovality which could have been produced by machining. As indicated earlier the method of machining according to the present invention minimises the distortion which would otherise occur to the wheel. This is because when machining cast wheels a "skin" of the casting is removed and as a result the metal tends to deform due to the stresses inherent in the casting. By machining the wheel in the orientation it will occupy when in use such distortion is reduced.

CLAIMS:

1. A method of balancing a wheel and tyre combination comprises:

(a) forming the mounting holes of the wheel concentrically about the rotational axis; and

(b) removing material from an area of the rim of the wheel to compensate for an eccentricity in the tyre itself.

2. A method as claimed in claim 1 in which the material is removed from the bead seats of the wheel.

3. A wheel manufactured by the method as claimed in claim 1 or 2.

4. A wheel and tyre combination in which the wheel is as claimed in any previous claim.

5. A wheel substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

6. A method of manufacturing a cast wheel substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report) - 10 -

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Relevant Technical fields

(i) UK Cl (Edition K) B7C (CKF); G1X

(ii) Int Cl (Edition 5) G01M

Search Examiner
C J DUFF

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
10 NOVEMBER 1992

Documents considered relevant following a search in respect of claims 1-6

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2067140 A	(MOTOR WHEEL CORP) whole document	1
A	US 4014139	(SHOOTER) column 3 lines 1-18; column 4 lines 9-36, 47-57	1
A	US 3808660	(WIK) column 2 line 58 - column 3 line 15; column 3 lines 24-52	1